- **Activity-based** – A measure of output whose benefit to water quality cannot be clearly quantified.
- **BMP Performance-based** – Monitoring results for a particular BMP or set of BMPs; expressed as pollutant concentration, pollutant reduction, or flow reduction.
- **Water Quality-based** – Monitoring results as determined from samples collected at an outfall, in-stream, or within a receiving water.

Other key terms will be identified and defined during the course of the workshop.

Agenda

Wednesday, March 21, 2018

9:00-9:30 am	**Welcome and Overview of Workshop Agenda**
	Tom Mumley, San Francisco Bay RWQCB and Wes Ganter, PG Environmental □ Welcome □ Introductions □ Review of Workshop Purpose and Agenda
9:30-10:45 am	**Session 1: Current Condition - Are the current Monitoring, Evaluation, Tracking and Reporting requirements effective?**
Conversation Starters: Dave Smith (EPA Region 9) and Grant Sharp (Orange County) *The objective of this retrospective session is to hear positive perspectives on the usefulness of current monitoring, evaluation, tracking and reporting requirements and to identify elements that are working well.* **Discussion:** *How effective has these program tools/requirements been in improving water quality, telling the story about what program effectiveness, and achieving other program objectives?*	
10:45-11:00 am	**Break**
11:00-2:00 pm	**Session 2: How Can We Better Use Performance Metrics To Facilitate Improved Monitoring, tracking, evaluation, and reporting?**
Conversation Starters: Nicole Beck (2nd Nature) and Dominic Roques (Central Coast Regional Water Board) **Discussion and Development of Findings and Recommendations** *1. Is it feasible to develop Performance Metrics for the Program and program elements and will this be helpful in improving water quality, telling the story about what program effectiveness, and achieving other program objectives?*	

2. Does the proposed construct and use of Activity-based, BMP-Performance-based, and Water-quality based Performance Metrics make sense? If not, what other approaches should be considered? *3. How can permits be improved to facilitate desired changes?*	
12:30-1:15 pm	**Obtain Lunch + Special Attraction- WEF's Stormwater Testing and Evaluation for Products and Practices (STEPP) initiative (Seth Brown, WEF)**
1:15-2:00 pm	**Continuation of Session 2 -**
2:00-2:30 pm	**Break**
2:30-4:15 pm	**Session 3: How Can We Make Outfall and Receiving Water Monitoring More Useful?**
Conversation Starters: Ken Schiff (SCCWRP) and Chris Minton (Larry Walker & Associates) **Discussion and Development of Findings and Recommendations:** *1. How effective has monitoring program tools/requirements been in improving water quality, telling the story about what program effectiveness, and achieving other program objectives?* *2. How can implementation of monitoring and evaluation be improved in the future?* *3. How can permits be improved to facilitate desired changes in monitoring and evaluation?*	
4:15-4:45	**Review of Day 1 and Initial Synthesis**

THURSDAY, MARCH 22, 2018

8:30-8:45	**Reset and Chart Day 2** Wes Ganter, PG Environmental
8:45-10:00	**Session 4: Linking Activities To Expected Water Quality Outcomes**
Conversation Starter: Bethany Bezak (DC Water) **Discussion and Development of Findings and Recommendations:** *1. How effective has these program tools/requirements been in improving water quality, telling the story about what program effectiveness, and achieving other program objectives?* *2. How can implementation of models and linked planning, monitoring, and data collection methods improve evaluation techniques in the future?* *3. How can permits be improved to facilitate desired changes in evaluation?*	

10:00-10:15 am	**Break**
10:15-11:30 am	**Session 5: How Can We Improve Program Performance Tracking?**
Conversation Starter: Randy Neprash (NMSA) **Discussion and Development of Findings and Recommendations:** *1. How effective have tracking tools/requirements been in improving water quality, telling the story about what program effectiveness, and achieving other program objectives?* *2. How can implementation of tracking be improved in the future? Are asset management programs the desired solution?* *3. How can permits be improved to facilitate desired changes in tracking?*	
11:30-12:30 pm	**Lunch: Special Attraction: Using Real Time Controls To Optimize Stormwater Management (Chad Helmle, Tetra Tech)**
12:30-1:45 pm	**Session 6: Reforming Reporting Approaches To Help Move Programs Forward and Give Permitting Authorities What They Need**
Conversation Starter: Elizabeth Ottinger (EPA Region 3- Philadelphia) **Discussion and Development of Findings and Recommendations:** *1. How can implementation of reporting be improved in the future?* *2. How can permits be improved to facilitate desired changes in reporting?* *3. Is there a model reporting format(s) that can be used as an example or template for programs and permits?*	
1:45-2:15 pm	**Break**
2:15-4:00 pm	**Session 7: Reflection, Synthesis, and Wrap Up**
☐ Identify areas of agreement, disagreement, or warranting more exploration. ☐ Review and fine tune findings and recommendations. ☐ How do we build capacity to use improved methods and approaches? ☐ How can we best bring about desirable change in permitting approaches (next steps)?	
4:00-4:30pm	**Meeting Evaluation and Closing**

APPENDIX C: PRE-WORKSHOP QUESTIONNAIRE RESULTS

This paper reports survey results. On the right side of each table, responses were summarized and shaded in cases where responses were particularly strong in one direction or the other, or very balanced. Please keep in mind this is not intended to be a statistically valid survey instrument. Thank you for your responses.

Key to Shading

- 80% or more agree or see improvement opportunity
- 70-79% agree or see improvement opportunity
- Even, <20% difference
- 70-79% disagree
- 80% or more disagree

1. Effectiveness evaluations, program tracking, and reporting - Assuming it is possible to improve and adjust these activities, how would you rate the potential for significant improvement (toward cost-effective environmental outcomes) for each element?

	Significant potential	Some potential	Little potential	No potential	No opinion or insufficient knowledge	TOTAL	Significant or Some Potential	Little or No Potential
Water Quality Monitoring (receiving water, outfall, within collection system, at project or practice scale)	19	5	0	0	0	24	100%	0%
Non-Water Quality Evaluation (activity evaluation, effectiveness evaluation)	15	6	2	0	1	24	88%	8%
Tracking (tracking discreet activities (e.g. inspections, street sweeping, BMP installation), active asset management planning and tracking)	12	12	0	0	0	24	100%	0%
Reporting (annual reporting to permit authorities, reporting to public or elected officials)	16	5	3	0	0	24	88%	13%

2. What are the key elements of program effectiveness? *(responses copied directly from survey results; not edited for grammar or spelling)*

- 1) Solid definition of performance metrics

2) Metrics that are linked to meaningful outcomes

3) Suite of activities that directly move those metrics in a measurable way

- We don't really know how our effective our programs are, generally. At the end of the day, we should be measuring impacts on water quality, but that has not been a focus for most programs for both political and financial reasons. Until we start to consistently and comprehensively measure performance, we will have no idea of real progress (or lack of progress).
- Key Elements are:
- Enhanced Awareness
- Behavior Change
- Estimating/Modeling Pollutant Reductions
- MS4 Monitoring
- Receiving Water Monitoring
- Clear articulation of the question wanting to answer, including time, space, and degree of change you're wanting to observe
- Clear and concise permit language that provides flexibility to meet water quality standards while requiring robust monitoring to demonstrate compliance.
- Improvements in water quality (both discharge quality and receiving water quality); reduction in pollutant load discharged (either through stormwater treatment or capture); elimination of non-stormwater discharges; elimination of waterbody impairments (and delisting from CWA section 303(d) list)
- Tracking progress of implementation efforts to improve water quality, including reporting of BMPs laid out in a plan (e.g., EWMP, WQIP, GI Plan).
- Clear and measurable performance metrics and the ability to gauge activities and actions versus those metrics; in the case of MS4 there has to be a tie to water quality improvement and/or protection - this is why we invest the time, money, and effort
- Effectiveness measurements that are:
- primarily outcomes (as opposed to outputs)
- appropriate for the specific BMP
- measured as close as possible in time and space to the result of a BMP
- expressed in a meaningful way (e.g., relative (%) as opposed to absolute)
- as appropriate and possible, expressed in lay terms
- We need clear articulation of program requirements, clear methods for associating actions with expected or observed water responses, and clear accountability expectations to ensure the stormwater agency communicates results clearly to the public and the permitting authority.
- Objective, outcome-based performance metrics. Not just checkboxes of "miles of street swept."

- Engagement and expertise at the MS4 level, adequate funding and authority, good asset management
- Ability to show water quality improvement, behavior change, and an overall understanding of the benefits and challenges associated with urban stormwater
- Spatially-explicit, quantifiable information on pollutant loading-reducing structural BMPs and implementation activities
- Close relationship between measured metrics and expected outcomes
- Receiving water quality improvements are the ultimate goal
- The key element of program effectiveness to me is the ability to establish a relationship between the BMP/action/activity and a reduction in pollutant loads.
- Understanding current level of effort (including common definitions to ensure consistent understanding of those efforts)
  Understanding desired outcomes and meaningful and measurable metrics
- What makes for an effective program?
  Effective programs need continual streams of funding. To obtain funding, program managers need the ability to communicate actions and environmental return both pre- and post-spend in formats easy to understand. Money is spent in specific locations. Spatially-based asset management allows implementation optimization and simplifies tracking and reporting.

3. Are program assessment requirements outdated and ineffectual?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Permits have been relatively inflexible, resulting in retention of less effective monitoring requirements and difficulty in initiating more effective and innovative approaches.	9	13	0	2	0	24	92%	8%
Permits have failed to include clearly defined performance metrics that can be fulfilled through coherent monitoring and evaluation approaches.	9	12	3	0	0	24	88%	0%
Permit monitoring and evaluation requirements have failed to adequately consider program size, complexity, and pollutants of concern.	8	8	5	2	1	24	67%	13%
Stormwater quality monitoring has been largely ineffective in assisting compliance evaluation, problem targeting, and program improvement.	12	9	2	1	0	24	88%	4%
The stormwater quality monitoring problems are attributable to lack of experimental designs that have well defined objectives, minimize sampling error and constrain the hydrologic variability in stormwater quality.	7	7	8	1	1	24	58%	8%
Receiving water monitoring has been only moderately effective for trend analysis and assessing attainment of water quality standards.	5	10	7	2	0	24	63%	8%
Receiving water problems are attributable to the inherent variability in receiving water quality, lack of expertise and time in evaluating collected data, difficulty of associating changes in receiving water quality to watershed sources, and high monitoring costs.	10	7	3	1	3	24	71%	17%
Making linkages between BMPs and activities and water quality outcomes has been hampered due to stagnant monitoring designs and a lack of defined performance metrics.	8	10	3	2	1	24	75%	13%
Monitoring data management and analysis systems have not evolved sufficiently to enable effective evaluation and comparison of monitoring results.	8	8	5	2	1	24	67%	13%
Tracking and reporting frameworks have not been adequately tied to performance metrics which hamper assessment and reduce cost-effectiveness.	14	6	3	1	0	24	83%	4%
Tracking and reporting frameworks have yet to acknowledge or endorse asset management systems.	11	11	2	0	0	24	92%	0%

Program and effectiveness evaluation should not be limited to permittees. The regulators (state and federal) should produce self-evaluations. These evaluations should include input from the full range of stakeholders (including permittees). The results of these evaluations should be made public for widespread distribution.	6	9	7	1	1	24	63%	8%
The programs for stormwater research have to change. Identifying, describing, and prioritizing research needs must be an open process that includes the full range of stakeholders (including permittees). The process should clearly define the research needs and publicize corresponding grant opportunities.	10	8	5	1	0	24	75%	4%
An improved process for technology transfer that translates and distributes research results useful for local implementers is needed.	13	9	1	0	1	24	92%	4%

4. Should we move toward a mix of Activity-based, BMP Performance-based, and Water Quality-based Performance Metrics, tailored to the local program design?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
No one monitoring and evaluation method addresses all the assessment needs; multiple approaches tailored to local circumstances are needed.	14	8	1	1	0	24	92%	4%
If permitees adopt a consistent performance metric-based accounting system (spatial or otherwise), permits can increase emphasis on performance achievement and reduce emphasis on burdensome record keeping.	10	6	6	2	0	24	67%	8%
It is recognized that permittees or regulators cannot reliably assess program effectiveness at spatial and time scales relevant to management decision making based solely on measured water quality outcomes.	11	7	5	0	1	24	75%	4%
Program managers and regulators need to continually review and update management/compliance questions to reflect changes in water quality issues and evolution of program approaches to inform monitoring program adaptation.	8	9	5	2	0	24	71%	8%
Extensive training and outreach for permit writers, program staff and elected officials will be needed to enable local programs to take this approach.	12	6	5	1	0	24	75%	4%
Asset management systems provide the ability to define and track a wide array of activity-based metrics.	10	10	4	0	0	24	83%	0%

Mobile enabled platforms are the most efficient way to facilitate and conduct field assessments and monitoring.	6	9	6	2	0	23	65%	9%
Metrics should enable evaluation not just of what was done, but also of whether those actions were effective.	16	7	1	0	0	24	96%	0%
Activity-based metrics should only be developed where BMP performance or water quality is difficult or impossible to measure.	4	5	2	9	4	24	38%	54%
Where programs have completed comprehensive plans identifying specific BMPs (e.g. through reasonable or other modeling), BMP Performance monitoring should be used to assess effectiveness.	6	14	1	2	1	24	83%	13%
BMP performance monitoring (water quality and/or volume reduction) should be used when stormwater assets are integrated with hydrologic tools to quantify impacts to receiving waters and cumulative BMP benefits.	6	12	4	2	0	24	75%	8%
Performance-based monitoring (water quality and volume reduction) can be used when BMPs are deployed in series to measure BMP effectiveness, assess maintenance needs, or to educate community stakeholders on program effectiveness.	5	13	6	0	0	24	75%	0%
Increased sampling of outfalls and locations within the collection system is needed to accurately target pollutant sources and evaluate BMP effectiveness within time scales of interest to permitting authorities and program managers.	7	8	4	3	2	24	63%	21%
Small systems may not need to perform water quality monitoring if alternative program evaluation and tracking approaches demonstrate effective BMP implementation and maintenance.	4	6	8	6	0	24	42%	25%
Performance metrics need to be established in concert with improved monitoring designs and methods (as more fully discussed in Session 3).	8	15	1	0	0	24	96%	0%
Focusing implementation actions and associated monitoring (and possibly even permits) in smaller watersheds or sewersheds improves capacity to evaluate implementation effectiveness and water quality responses.	8	10	6	0	0	24	75%	0%

5. How Can We Make Outfall and Receiving Water Monitoring More Useful?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Program managers and regulators need to continually review and update management/compliance questions to reflect changes in water quality issues and evolution of program approaches to inform monitoring program adaptation.	9	11	4	0	0	24	83%	0%
Water monitoring should continue but based on improved design and methods and tighter connection to performance metrics and program objectives.	13	8	2	0	1	24	88%	4%
Surrogate measures (e.g., fine sediment, flow) are a viable option for reducing analytical costs and increasing power for identifying spatial patterns and changes over time.	7	9	7	1	0	24	67%	4%
Instream monitoring requirements should be reduced in order to increase monitoring of outfalls, BMP effectiveness, and/or BMP assessments.	10	6	4	3	1	24	67%	17%
Water quality change detection will be enhanced with accounting of flow conditions coincident with sampling and guidance for how to use flow data to improve analysis	10	7	6	1	0	24	71%	4%
Monitoring designs must go beyond just data collection methods to include data management, data analysis, and reporting formats that clearly link data collected with Performance metrics.	13	11	0	0	0	24	100%	0%
New sampling methods (e.g. automated samplers) and designs can yield more reliable data to help answer management questions and assist real-time project and system management.	8	9	6	1	0	24	71%	4%
Permit language will need to be modified to authorize use of new methods and designs.	10	7	6	1	0	24	71%	4%
Training and outreach for permit writers, program staff, and elected officials on new methods and designs are needed to familiarize these groups with their benefits and limitations.	12	10	0	2	0	24	92%	8%

6. How can we better link activities to outcomes?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Targeting implementation and monitoring in smaller areas increases likelihood of demonstrating linkages between implementation activities and water quality responses.	10	12	1	1	0	24	92%	4%
Using predictive watershed and BMP siting models can provide the analytical framework necessary to relate activity/BMP implementation measures to expected water quality outcomes.	6	11	5	2	0	24	71%	8%
Where model-based approaches are used for linkage in planning, monitoring may need to focus more on collection of data to support model validation and sensitivity analysis.	14	8	2	0	0	24	92%	0%
Where robust models and associated implementation plans are in place, it may be appropriate to reduce and/or strategically focus annual water quality monitoring requirements.	10	10	2	1	1	24	83%	8%
More complicated linkage methods may be unnecessary for simpler Phase II permits or other permits that do not focus on specific water quality issues.	7	12	3	2	0	24	79%	8%
Outreach and training will be needed to build local capacity to implement these planning and linkage methods.	11	11	1	1	0	24	92%	4%

7. How can we improve program tracking performance?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Building an integrated activity tracking, evaluation, and reporting system enables more coordinated program management and adjustment, and clearer permit reporting.	13	8	2	1	0	24	88%	4%
Information/data management needs to improve to move past static compilation of activity measures to use of integrated information management systems that synthesize data geographically and support real-time management decision making.	16	5	3	0	0	24	88%	0%
Tracking locations, capacity, types, and performance (or maintenance status) of structural BMPs are a useful metric for determining program progress and permit compliance on short time frames, and this information can inform planning and prioritization.	14	7	3	0	0	24	88%	0%
Implementing more holistic asset management approaches provides appropriate framework for systematic performance tracking.	10	9	5	0	0	24	79%	0%
Training and examples will be needed to assist communities in implementing new methods and incorporating them in permits.	13	7	3	1	0	24	83%	4%

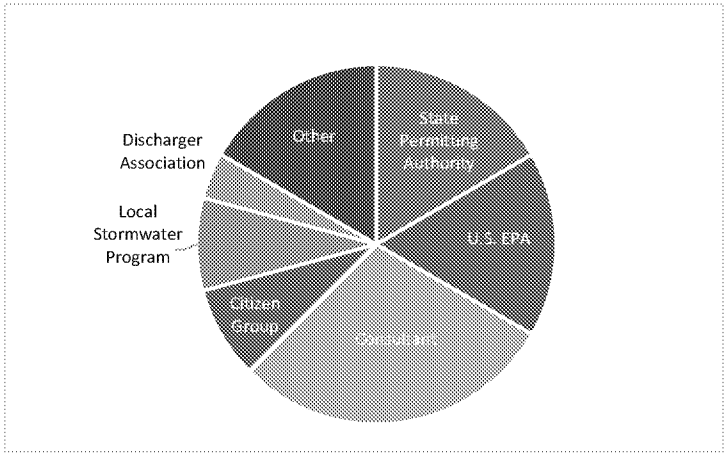
8. How can we reform reporting approaches to help move programs forward and give permitting authorities what they need?

	Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	TOTAL	Strongly Agree or Agree	Strongly Disagree or Disagree
Reporting requirements should move beyond passive activity and data tallies to incorporate active effectiveness evaluation and clear linkages to program actions.	15	7	1	1	0	24	92%	4%
Focusing more on program elements that are linked directly to quantifiable water quality outcomes (e.g. BMP maintenance), and reporting tools that provide transparent accounting of benefits and are field verifiable will accelerate progress and provide useful information to decision makers.	12	10	1	1	0	24	92%	4%
Future reporting systems should be able to incorporate new information as permit requirements, opportunities and technology shifts over time while providing outputs that clearly communicate program implementation/success.	13	8	2	1	0	24	88%	4%
Better guidance and training on new reporting frameworks and how to incorporate them in permits will be needed to advance reporting approaches at the state and local levels.	12	10	1	1	0	24	92%	4%
Electronic reporting will not improve reporting quality unless more measurable and evaluative metrics are associated with program activities.	10	11	3	0	0	24	88%	0%
Reporting requirements should be scaled based on program complexity; smaller programs need not report in as much detail as larger programs.	9	5	6	1	2	23	61%	13%

9. Do you have any additional comments or suggestions for the workshop? *(responses copied directly from survey results; not edited for grammar or spelling)*

- These questions are very thoughtful and should be plenty to start the discussion.
- There isn't one right answer for every program, but there must be a better monitoring/tracking/assessment framework that could be used to build more effective programs across the country.
- Effectiveness assessment is element-specific. No one measurement fits all. So, rather than specifying a measurement, specify a process to follow between the different elements to identify the appropriate measurement, etc. Process would be something like:
  Inquiry (question, permit req, exceedance) → POC → BMP → Effectiveness measurement → Effectiveness methodology → Report
- Focus on solutions, and try to identify how and by whom recommended actions can be implemented.
- I wish similar workshops were conducted throughout the entire country for all levels of MS4 implementers (permitttees, permit writers, regulators, inspectors, etc.). Perhaps that will be an outcome of this workshop (fingers crossed!).
- It's going to be awesome!
- Great job with the hypotheses - they are very thorough. I was energized just by reading through them.
- We should discuss the role sand responsibilities of the regulators (EPA & states) as well as the permittees.

What type of organization do you represent (or is your employer)?



Answer Choices	Responses	
State Permitting Authority	4	17%
U.S. EPA	4	17%
Consultant	7	30%
Citizen Group	2	9%
Local Stormwater Program	2	9%
Trade Association	1	4%
Other	4	17%

Commented [GB8]: See earlier comment.

Commented [SD9R8]: PG, pls change pie chart label to refer to Trade Association